(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 655 774 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
17.07.1996 Bulletin 1996/29

(43) Date of publication A2:
31.05.1995 Bulletin 1995/22

(21) Application number: **94117286.8**

(22) Date of filing: **02.11.1994**

(51) Int. Cl.[6]: **H01L 21/20**, B23K 26/06

(84) Designated Contracting States:
DE FR GB NL

(30) Priority: **02.11.1993 JP 297399/93**
23.02.1994 JP 49801/94

(71) Applicant: **SONY CORPORATION**
Tokyo 141 (JP)

(72) Inventors:
- **Noguchi, Takashi,**
  c/o Sony Corporation
  Shinagawa-ku, Tokyo (JP)
- **Ogawa, Tohru,**
  c/o Sony Corporation
  Shinagawa-ku, Tokyo (JP)
- **Ikeda, Yuji,**
  c/o Sony Corporation
  Shinagawa-ku, Tokyo (JP)

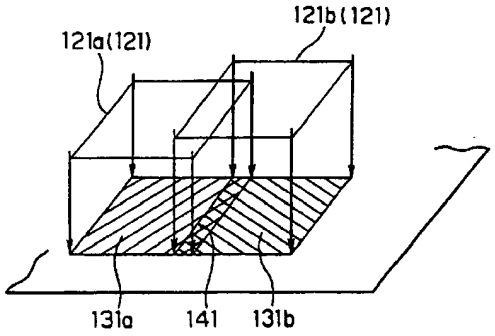
(74) Representative: **TER MEER - MÜLLER - STEINMEISTER & PARTNER**
Mauerkircherstrasse 45
81679 München (DE)

(54) Method of forming polycrystalline silicon layer and surface treatment apparatus therefor

(57) A method of forming a polycrystalline silicon thin film improved in crystallinity and a channel of a transistor superior in electrical characteristics by the use of such a polycrystalline silicon thin film. An amorphous silicon layer of a thickness preferably of 30 nm to 50 nm is formed on a substrate. Next, substrate heating is performed to set the amorphous silicon layer to preferably 350°C to 500°C, more preferably 350°C to 450°C. Then, at least the amorphous silicon layer is exposed to laser light of an excimer laser in an extent greater than approximiately 10 cm^2 by single shot exposure. The energy density is 100 mJ/cm^2 to 500 mJ/cm^2, preferably 280 mJ/cm^2 to 330 mJ/cm^2. The pulse width is 80 ns to 200 ns, preferably 140 ns to 200 ns, so as to directly anneal the amorphous silicon layer and form a polycrystalline silicon thin film. The total energy of the laser used for the irradiation of excimer laser light is at least 5J, preferably at least 10J.

A surface treatment laser appraratus and different surface treatments e.g. oxidation or nitridation are also described.

FIG. 1



EP 0 655 774 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 11 7286

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y A	EP-A-0 373 055 (COMMISSARIAT À L'ÉNERGIE ATOMIQUE) * the whole document *	11,13, 17,23,27 19,25,28	H01L21/20 B23K26/06
Y A	US-A-4 970 546 (NIKON CORPORATION) * the whole document *	11,13, 17,23,27 9,18,19, 21,22,24	
A	PATENT ABSTRACTS OF JAPAN vol. 17, no. 89 (E-1323), 22 February 1993 & JP-A-04 282869 (JII TEI SHII KK), 7 October 1992, * abstract *	1,7	
A	INTERNATIONAL ELECTRON DEVICES MEETING-WASHINGTON US, 8 - 11 December 1991, pages 563-566, XP002003298 H. KURIYAMA ET AL.: "high mobility poly-si tft by a new excimer laser annealing method for large area electonics" * page 564; figure 2 * * page 564, column 2, paragraph 2 *	1-3	TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01L B23K
A	PATENT ABSTRACTS OF JAPAN vol. 17, no. 398 (E-1403), 26 July 1993 & JP-A-05 074704 (SEIKO EPSON CORP.), 26 March 1993, * abstract *	4	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 May 1996	Aran, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 11 7286

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EIGHTH E.C. PHOTOVOLTAIC SOLAR ENERGY CONFERENCE-FLORENCE IT, 9 - 13 May 1988, pages 1280-1284, XP002003299 I. REIS ET AL.: "recrystallization of polycrystalline silicon layers by an optical heating technique" * abstract *	1,7	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 May 1996	Aran, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)